

feeder 8, and exhaust gas pipe 10 and inlet gas pipes 11. The boat holder 4 is fixed to the base 1, and is provided in the inner space of the inner tube 3. The gas feeder 8 is provided in the inner space of the inner tube 3, and vertically extends from the hole toward the other end of the inner tube 3. The heaters 7a, 7b and 7c are provided around the outer tube 2, and, accordingly, the outer tube 2 is wrapped in the heaters 7a, 7b and 7c. The gas supply system is connected through the inlet gas pipes 11 to the inlet gas ports of the outer tube 2. One of the inlet gas pipes is open through the inlet gas port to the cylindrical space, and another pipe is open to the hole formed in the inner tube 3. Yet another inlet gas pipe is connected through the inlet gas port to the gas feeder 8, and the exhaust pipe 10 is connected to the gas outlet port of the outer tube 2. Though not shown in figure 1, a pressure regulator is connected to the exhaust pipe 10, and the pressure regulator keeps the pressure in prior art reactor constant.--

Please replace the paragraph beginning at page 4, line 3, with the following rewritten paragraph:

--A problem is encountered in the prior art reactor in that the layers of deposited substance are different thickness. Since the gas outlet holes 9 are equal in diameter and constant in density, the pressure gradient takes place inside the gas feeder 8 as indicated by arrows AR in figure 2. The arrows AR are representative of the gas pressure. When the gas outlet holes 9 are spaced from the inlet end or the open end, the arrow AR becomes shorter. The lowest arrow AR is the longest of all, and the highest arrow AR is the shortest of all. This is because of the fact that the pressure is reduced from the open end toward the closed end. The higher the gas pressure is, the larger the flow-rate is. As a result, the concentration of the reactant gas is varied

HAYES SOLOWAY P.C.  
130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

with the distance from the lower end of the gas feeder 8. When a large amount of reactant gas is supplied to a semiconductor wafer, the deposition rate is increased. This results in the difference in thickness.--

Please replace the paragraph beginning at page 5, line 1, with the following rewritten paragraph:

--A solution is proposed in Japanese Patent Publication of Unexamined Application No. 58-197724. The prior art chemical vapor deposition system disclosed therein is equipped with a gas feeder 8a, which is corresponding to the gas feeder 8, shown in figure 3. The gaseous mixture is blown from the gas feeder 8a to semiconductor wafers supported by a wafer boat. A plurality of gas outlet holes 9a/9b are formed in the prior art gas feeder 8a as similar to the prior art gas feeder 8. However, the gas outlet holes 9a/9b are neither equal to diameter nor constant in density. The diameter is decreased from the open end toward the closed end, and the density of gas outlet holes 9a/9b are increased toward the closed end. The diameter and the density are designed in such a manner that the gas flow rate is constant over the gas feeder 8a. Since the gas concentration of the reactant gas is well controlled over the wafer boat, the deposition rate is substantially constant in the wafer boat. For this reason, any dummy wafer is not required for the prior art chemical vapor deposition reactor, and the throughput is maintained without sacrifice of the uniformity of the deposited substance.--

Please replace the paragraph beginning at page 5, line 17, with the following rewritten paragraph:

--However, a problem is encountered in the prior art chemical vapor deposition reactor due to the gas outlet holes 9a/9b. In detail, the small gas outlet holes 9a are formed in the vicinity

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

of the closed end of the gas feeder 8a at high density, and the large gas outlet holes 9b are formed in the vicinity of the open end of the gas feeder 8a. The small holes are much more liable to be clogged with the by-products, and the prior art gas feeder 8a requires cleaning frequently. If the cleaning is not frequently repeated, the semiconductor wafers are contaminated with the by-products, and the yield is lowered. Thus, the maintenance work is frequently required for removing the by-products from the prior art gas feeder 8a. On the other hand, the large gas outlet holes 9b makes the prior art gas feeder 8a breakable, because the larger gas outlet holes 9b seriously reduce the surface area of the open end portion of the prior art gas feeder 8a. This means that the prior art gas feeder 8a requires an inspection and a maintenance work at short intervals. Thus, a new problem is encountered in the prior art chemical vapor deposition reactor equipped with the gas feeder 8a in the maintenance works to be carried out at short intervals.--

Please replace the paragraph beginning at page 10, line 5, with the following rewritten paragraph:

--The inner tube 3 has a tubular configuration, and is less in diameter than the shell of the outer tube 2. The inner tube 3 is constant in inner diameter, and is shorter than the outer tube 2. No head is attached to the inner tube 3, and, accordingly, the inner tube 3 is open at both ends thereof. The inner tube 3 is provided inside the outer tube 2, and is connected to the base structure 1. The inner tube 3 is upright on the base plate of the base structure 1. A gap exists between the inner tube 3 and the outer tube 2, and the inlet gas port and the outlet gas port are open to the tubular space between the inner tube 3 and the outer tube 2. An opening is formed in one end portion of the inner tube 3, and is close to the circular rim of the base structure 1. The tubular space is connected to the inner space inside of the inner tube 3 through the opening.--

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

Please replace the paragraph beginning at page 10, line 17, with the following rewritten paragraph:

A7 --The reactor further included a boat holder 4, heaters 7a, 7b and 7c and a gas feeder 8B. The boat holder 4 is provided inside the inner tube 3, and is placed on the base plate of the base structure 1. A tubular space exists between the inner tube 3 and the wafer boat 5. The boat holder 4 is fixed to the base structure 1, and a wafer boat 5 is to be put on the boat holder 4. The semiconductor wafers 6 are supported by the wafer boat 5. The wafer boat 5 is elongated in the vertical direction on the boat holder 4, and semiconductor wafers 6 are spaced from one another in the wafer boat 5 in the vertical direction on the boat holder 4. --

Please replace the paragraph beginning at page 11, line 11, with the following rewritten paragraph:

A8 --The gas feeder 8B is provided in the tubular space between the inner tube 3 and the wafer boat 5, and vertically extends along the wafer boat 5. An inner space is defined in the gas feeder 8B, and also extends along the wafer boat 5. The gas supply system is connected through the gas inlet port to the gas feeder 8B, and the gas inlet port is formed at the lower end portion of the gas feeder 8B. The upper end portion of the gas feeder 8B is closed, and gas outlet holes 9C are formed at regular intervals in the intermediate portion of the gas feeder 8B. The gas outlet holes 9 are vertically spaced from one another, and are directed to the wafer boat 5.--

Please replace the paragraph beginning at page 11, line 20, with the following rewritten paragraph:

A9 --The inner space in the gas feeder 8B is gradually decreased in horizontal cross section from the lower end portion toward the upper end portion. Cones, frustums of cones, pyramids

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

and frustums of pyramids are typical examples of the configuration gradually decreased in the cross section. However, it is impossible to place a cone-shaped or a pyramidal gas feeder inside the inner tube 3, because most of the inner space is occupied by the wafer boat 5. For this reason, the gas feeder 8B is shaped into a part of the peripheral portion of a frustum of cone as shown in figures 6 and 7. When a circular cylinder is pressed against a frustum of conical tube, the frustum of conical tube is inwardly depressed, and the resultant configuration is similar to that of the gas feeder 8B. The cross section is like a crescent (see figure 7). A convex surface, a concave surface and a pair of semi-cylindrical surfaces, an upper surface and bottom surface form the gas feeder 8B. The gas outlet holes 9C are formed in the concave surface along a virtual line, which is substantially in parallel to the vertical centerline of the wafer boat 5.--

Please replace the paragraph beginning at page 12, line 12, with the following rewritten paragraph:

--The gas outlet holes 9C are equal in diameter, and are spaced at regular intervals. The diameter of the gas outlet holes 9C is greater than that of the small gas outlet holes 9a formed in the upper end portions of the gas feeder 8a, and is less than that of the large gas outlet holes 9b formed in the lower portion of the gas feeder 8a of the prior art figure 3. For this reason, the gas outlet holes 9C are easily formed in the gas feeder 8B, and are less liable to be clogged with the by-products. The inner space of the gas feeder 8B has a horizontal cross section, which is gradually decreased in area from the lower end toward the upper end. The inner space is designed in such a manner as to eliminate the pressure gradient from the gas in the inner space of the gas feeder 8B. In other words, the gas pressure at all of the gas outlet holes 9C is constant regardless of the position of the gas outlet holes 9C as indicated by arrows (see figure 8). Since the gas

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
FAX. 520.882.7643

175 CANAL STREET  
MANCHESTER, NH 03101  
TEL. 603.668.1400  
FAX. 603.668.8567

AD  
outlet holes 9C are equal in diameter to one another, the amount of gas blowing out from each gas outlet hole 9C is approximately equal to that blowing out from another of the gas outlet holes 9C. In this instance, the doping gas is supplied from the gas supply system to the gas feeder 8B, and is blown to the semiconductor wafers 6 in the wafer boat 5 for in-situ doping. The gas feeder 8B uniformly supplies the doping gas to the semiconductor wafers 6, and the dopant is uniformly introduced into the substance deposited on all the semiconductor wafers 6.--

Please replace the paragraph beginning at page 13, line 9, with the following rewritten paragraph:

--Assuming now that phospho-silicate glass is to be uniformly deposited on all semiconductor wafers 6, the heaters 7a, 7b and 7c raises the temperature inside the reactor, and the pressure regulator (not shown) regulates the internal gas at a target pressure. The heaters 7a, 7b and 7c keeps the gas at the target temperature, and the pressure regulator (not shown) keeps the internal gas at the target pressure. The reactant gas TEOS, the doping gas such as  $\text{PH}_3$  and the dilution gas  $\text{N}_2$  are supplied from the gas supply system through the gas pipes 11 to the reactor. The reactant gas TEOS is decomposed so that silicon oxide is deposited over the semiconductor wafers 6. The doping gas  $\text{PH}_3$  is supplied through the gas inlet port to the gas feeder 8B, and is blown to the silicon oxide grown on the semiconductor wafers 6. The phosphorous is introduced into the silicon oxide, and the phospho-silicate glass is grown on the semiconductor wafers 6. Since the doping gas concentration is constant around the semiconductor wafers 6 in the wafer boat 5, the phosphorous concentration is constant in the phospho-silicate glass deposited on all the semiconductor wafers 6.--

HAYES SOLOWAY P.C.

130 W. CUSHING ST.  
TUCSON, AZ 85701  
TEL. 520.882.7623  
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175 CANAL STREET  
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FAX. 603.668.8567